TESTIMONY OF

JULIA FRAYER

I, Julia Frayer, declare:

1. I am an applied economic consultant, specializing in the electricity sector and other infrastructure industries. I am one of the partners and a Managing Director of London Economics International LLC ("LEI"). As Managing Director, I currently direct many of the company's engagements involving market design and policy making in electricity markets, particularly with respect to auction design and market power regulations. A detailed summary of my credentials is set forth in Appendix A, attached to this testimony.

At the request of the staff at California Energy Commission ("CEC"), I have been asked to conduct a review of the declarations and analysis prepared by the Investor Owned Utilities ("IOUs") (and their market experts) in their appeal of the June 3, 2005 *Notice of Intent to Release Aggregated Data* (the "NOI") issued by the Executive Director of the CEC to release aggregated summary tables on future supply-demand balances. My testimony summarizes the conclusions drawn from my review and investigation of the various documents and reports submitted by the IOUs, my professional experience with similar market processes, and well-accepted economic theory.

2. **Summary of key conclusions:** I reviewed the declarations and analyses prepared by the IOUs and have found that their investigation of the situation is not representative of actual market realities in California. In light of actual market conditions and the character of the aggregated summary tables, economic and market theories on information policies do not support the IOUs' contentions on broadly three grounds.

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First, the claims made by the IOUs and their market experts are based on abstracted experimental analysis which ignores key considerations of the actual procurement processes of the IOUs and the current market environment for electricity supply. For example, the experimental study conducted by Professor Charles Plott (attached in the declaration filed by Southern California Edison Company ("SCE")) assumes that competition among suppliers is fixed (e.g., there are no new entrants or retirements) – an assumption that is inherently flawed, given the dynamism in a deregulated, competitive electricity market and, specifically, actual experience in California's electricity sector to date. In addition, the experimental study uses very different data assumptions from the aggregated summary tables that are at issue in this proceeding. Professor Plott tests the impact of continuously revealing the entire demand curve (which consists of quantities for the hypothetical product that the buyer is seeking to procure *and* the marginal value that the buyer places on each incremental quantity) in his experiments. The aggregated summary tables that are proposed to be revealed by the NOI will not be as extensive as the demand curve data revealed in the experimental analysis, nor will suppliers have access to continuous updates on the marginal value that the IOUs place on each MW of energy and capacity to be procured. In all reasonableness, by the time the CEC releases the aggregated summary tables as part of the *2005 Energy Report* process, the underlying information will have been outdated by at least six months. Moreover, the confidentiality already guaranteed to the first three years of data (2006-2008) makes Professor Plott's experimental study a less appropriate comparison. Furthermore, the IOUs and their market experts characterize the aggregated summary tables as a "trade secret" composed of private, wholly original information. In reality, these aggregated summary tables serve as a refinement of the existing public knowledge base, effectively a replacement (or

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substitute) for already available information. As I discuss further below, economic theory can allow us to conclude that information policies which require the gathering and dissemination of information from buyers in an auction process reduces uncertainty for the sellers and serves as a substitute for pre-existing, less accurate, assumptions regarding that information made privately by some sellers. Though economic theory suggests that there are a number of (conflicting) effects brought about by the introduction of information, to the extent that the new data is a refinement of existing private information held by some sellers, it will improve outcomes for buyers (i.e., resulting in a lower price, *ceteris paribus*). Professor Plott's experimental study has not been designed to assess the impact of refined information, as represented by the aggregated summary tables.

Second, the IOUs' concerns about possible "manipulation" disregard the safeguards included in the NOI, such as the aggregation of the monthly raw data, the three-year confidentiality window (during which period most utility procurement is currently conducted), and the market structure within which procurement processes are undertaken. Auction theory suggests that the presence of market power (such as collusive behavior among bidders (i.e., suppliers)) would lead to sub-optimal outcomes. However, the IOUs do not substantiate their market power concerns in light of the aggregated summary tables release proposal in the NOI. The declarations provided by the IOUs coyly imply coordinated interaction among suppliers, but do not describe how these interactions are realized or how current structural elements in California support these implications. Given the current market structure in the state, with many qualified suppliers and the potential for many new suppliers in the longer term, economic theory would suggest that coordinated action (even tacit collusion) is unlikely. Rather, economic theory in conjunction with the existing market

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structures would suggest that workable competition is the norm. Accordingly, information dissemination, such as that proposed in the NOI, should reduce uncertainties of suppliers and provide for more efficient market outcomes under a competitive market structure, including lower prices as a result of lower embedded risk premiums in the offers of suppliers and aggressive competition among existing suppliers, as well as competitive pressures from possible new development. James Shandalov, an independent consultant retained by Pacific Gas and Electric Company ("PG&E") refers to what a (single) marketer would do with certain information, and then later jumps to statements concerning the "inadvertent" actions of the whole market, without addressing how a single supplier's use of the information translates into an abuse of the information on a market-wide basis.[1] Though Professor Plott is more up-front in stating that his study's objective was to capture the "strategic behaviors that exist in the market,"[2] it is unclear whether his experimental study accurately represents the current market structure in California, with the three large buyers and dozens of existing suppliers (he never explicitly documents the number of sellers and buyers that participated in his experimental sessions). We do know for a fact that this experimental study does not take into account the impact of potential new entrants. Moreover, the experimental study captures the impact of information dissemination on a real-time basis to all suppliers, rather than the forward-looking aggregated quantity points to be released according to the NOI on a lagged, biennial basis as part of the cyclical planning process.

Third, the analyses presented by the IOUs and their market experts ignore the harmful consequences for ratepayers over the long-term if such aggregated summary tables are not released. The aggregated summary tables provide useful

[1] Mr. Shandalov uses the adverb "inadvertently" in a number of instances in his testimony. *See* Shandalov at 10, 12, and 14.

[2] *See* Plott at 6.

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and very important signals for new investment. Such signals will motivate new investment in generation, expand the competitive opportunities for buyers to procure energy, and thus provide secure and reasonably priced supply for ratepayers in the future. In my professional opinion, the aggregated summary tables are not a "trade secret" because their release will benefit ratepayers.

3. **For introductory purposes, it is useful to quickly summarize the aggregated summary tables that are being disputed at the July 13, 2005 hearing.** In January 2005[3], in preparation of procurement recommendations in the *2005 Integrated Energy Policy Report* ("IEPR"), the CEC requested detailed information from the resource plans prepared by California's Load Serving Entities ("LSEs").[4] LSEs in California were obligated to file detailed resource plans in 2004 with the California Public Utility Commission ("CPUC") for the 2006-2016 timeframe. The information requested by CEC in its January 2005 publication, *Forms and Instructions for the Electricity Resources and Bulk Transmission Data Submission,* included: S-1 Capacity Resource Accounting Table, S-2 Energy Balance Accounting Table, S-3 Generic Renewable Capacity and Energy Locations, S-4 Projected QF Energy and Costs, and S-5 Bilateral Contracts.

The LSEs complied with the data request in March and April 2005, though also requesting confidentiality. The information filed with the CEC stemmed from resource plans prepared by the LSEs as far back as the first half of 2004 when the IOUs submitted their Long Term Procurement Plants to the CPUC.[5]

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[3] The first workshops where resource plan data needs were discussed occurred in November 2004. The actual Supply Forms and Instructions were adopted on January 19, 2005 with supplemental Forms & Instructions adopted on March 2, 2005.

[4] The California Public Resource Code Section 25301 directs the CEC to conduct regular assessments of all aspects of energy demand and supply. To perform these assessments and forecasts, the CEC may require the submission of demand forecasts, resource plans, market assessments, and related outlooks from electric and natural gas utilities, transportation fuel and technology suppliers, and other market participants." (From PRC 25301 (a))

[5] IOU Long Term Procurement Plants ("LTPPs") were officially filed July 9, 2004.

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On June 3, 2005, the CEC Executive Director proposed an NOI to release in aggregated form the projected energy consumption/production and peak demand/productive capacity data provided by the IOUs. These aggregated summary tables would be released as part of the 2005 Energy Report Process (the 2005 IEPR is expected to be complete in October 2005). There are currently three proposals for aggregating the data across geographical dimensions. All three proposals incorporate aggregation of the raw data in terms of time and by resource category. The temporal aggregation will result in monthly data being transformed into quarterly and annual reference points. The resource aggregation will combine individual resource listings into categories of resources, such as utility controlled fossil resources or existing renewable contracts. The three geographical dimensions proposed in the NOI include: (1) bundled IOU specific tables for each scenario, (2) planning area tables for each scenario, and, (3) planning areas tables showing capacity scenario ranges.

The IOUs have objected to the release of certain portions of the aggregated annual data (specifically the capacity-based figures for the bundled IOU geographic dimension), and to all the quarterly tables (across all three geographic dimensions). The IOUs claim that the information – even in aggregated form – is commercially sensitive and they are entitled to the "trade secret" exemption from disclosure under the Public Records Act. The IOUs' specific objections to the NOI are detailed in Dr. Michael Jaske's testimony.

Driving these objections to the aggregated summary tables' release are several specific concerns. First, the IOUs are concerned that the release of the aggregated summary tables would allow suppliers to manipulate negotiations with the IOUs, thereby causing harm to ratepayers. More specifically, the IOUs claim that ratepayers would pay higher prices than if the contested aggregated summary tables were not released. These claims are based on observations from

Professor Plott's experimental study of a hypothetical market environment and James Shandalov's testimony from his market experiences as a trader (prior, during, and for some time after the California electricity crisis of 2000-2001), as well as the testimony of Kevin Cini, director of Energy Supply and Management at SCE. Mr. Shandalov claims that "suppliers' possession of the market sensitive information could result in ratepayer harm in the form of higher procurement costs," but only "inadvertently."[6] As I discuss further below, the arguments laid out by the IOUs and their market experts conflict with the reality of the NOI, fail to represent the actual commercial arrangements in the market (including availability of similar data) and existing market structure in the state, and conflict with well-accepted economic theory on the impact of the release of refined information (as represented by the aggregated summary tables) in such a market environment.

4. In order to understand the theoretical considerations suggested by economic and auction design theory, as well as the shortcomings of the IOUs' arguments regarding ratepayer harm, it is useful to have a realistic characterization of the current electricity market in California, and especially the procurement process by which the three IOUs (the major "buyers" of electricity, on behalf of ratepayers) interact with suppliers.

First, it is important to note that there are many buyers and sellers of wholesale electricity in the California market.[7] While there are a few large buyers of wholesale electricity (essentially the three IOUs), there are also numerous medium-sized buyers, such as the Sacramento Municipal Utility District,

[6] *See* Shandalov at 1 and at 10, 12, 14.

[7] I use the term "California market" broadly in this testimony. Although I realize that currently there is no centralized day ahead market for electricity, there are still suppliers and buyers interacting and selling and buying electricity from each other through a number of informal, decentralized platforms. Thus, when I refer to the California market for electricity, I am making a statement about the informal trading and the general electricity market dynamics in the state.

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Imperial Irrigation District, the City of Anaheim, and Modesto Irrigation District, and other third-party retailers (procuring on behalf of large industrial customers). Almost 20% of California's load is industrial.[8]

There are also many suppliers of electricity. As of the beginning of 2005, there were more than 50 holding companies that owned generation with aggregated installed capacity of more than 100 MW, with more than a dozen holding companies owning more than a total of 1,000 MW each in the state of California.[9] In addition, California imports significant amounts of electricity from generators in the Pacific Northwest and in the Southwest. Indeed, on an average hourly basis, the California Independent System Operator ("CAISO") coordinates imports of 3,765 MW from Arizona, 569 MW from Nevada and Utah, and 2,457 MW from the Pacific Northwest.[10] There are more than 20 electricity generation companies in the Pacific Northwest with more than 100 MW of aggregated installed capacity as well as another 20 plus electricity generation companies with more than a total of 100 MW each in the remaining portion of Western Electricity Coordinating Council ("WECC") that covers the Rocky Mountain, Arizona, Southern Nevada, and New Mexico region.[11]

The make-up of existing generation resources in California is regionally distinct, with a hydro-dominated northern California and primarily gas generation on the margin in Southern California. The seasonal shifts in available generation are already well-known and documented given the wealth of historical and short-term information on hydrological conditions. Furthermore, this unique characteristic of the California market (short-term seasonality and

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8 Energy Information Agency ("EIA") statistics, 2003.

9 Based on current data from *E-Velocity*, a commercial information vendor that compiles data submitted to the Federal Energy Regulatory Commission ("FERC"), EIA, the Environmental Protection Agency ("EPA"), the Securities and Exchange Commission ("SEC"), and WECC, as well as data from corporate annual and quarterly reports.

10 FERC's *State of the Markets Report*, June 2005, p. 73.

11 Based on data from *E-Velocity*.

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longer term cyclicality of hydro-electric generation in northern California) is important because of its impact on long-term planning needs for hydro-dependent northern California. Market signals, such as the aggregated summary tables, need to represent this short-term seasonality so that proper investments take place.

A second important characteristic of the California procurement process for electricity is that buyers and sellers have many alternative forums for engaging in market transactions. Buyers, specifically the IOUs, can buy on the spot market, use their own resources to meet demand, call on long-term contracts, and also procure from the bilateral market in terms of up to ten years (though the IOUs have noted that currently terms of up to five years are more typical). As such, the procurement process for most LSEs in California occurs over a short to medium term horizon. Likewise, suppliers have a variety of options available to them in terms of selling their energy, whether it be through the spot market, through medium-term bilateral contracts, or through a more official Request for Offer ("RFO") process, like the kind initiated by SCE just last week.[12] The numerous avenues for transactions across time for California's buyers of electricity and suppliers, coupled with the number of market participants, suggests a complex market structure which would be difficult to manipulate or game.

Another characteristic of a competitive electricity industry is the volume of information readily available for both suppliers and buyers of electricity, and this is particularly the case for California, given the organized markets operated by the CAISO and state and federal agency oversight. Dr. Michael Jaske

[12] On July 1, 2005, SCE launched an RFO seeking contracts up to 56 months in length (less than five years) to serve its Southern California load. Contracts being sought include dispatchable unit-contingent tolling agreements, non-dispatchable qualifying facilities resources, unit dispatch call options, and daily call options from existing or newly constructed resources.

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describes in his testimony the substantial data provided by generators and LSEs to FERC, the EPA, and the WECC, which is made publicly available on a regular basis. Indeed, there are also many proxies for the forecast energy and capacity data that the IOUs are arguing to keep confidential, such as those provided as part of the annual CAISO grid planning process as discussed in more detail in Dr. Michael Jaske's testimony, as well as the North American Electricity Reliability Council ("NERC") regional assessments.

In addition to the detailed information that market participants are required to file with federal and state regulatory agencies, there is a large amount of publicly available information on wholesale market price and volume dynamics facilitating the buying and selling process. For example, the CAISO manages markets for real-time imbalance energy and ancillary services, providing public price indications for both. In addition, other energy price indices for spot, near term, and forward markets are available from several different bilateral price indices such as Platts, Dow Jones, and the InterContintentalExchange ("ICE"). Platts provides day ahead peak and off peak average price data for SP15 (the zone covering Southern California), NP15 (the zone covering Northern California), and COB (the California Oregon border zone), as well as forward prices for SP15 and NP15 through the end of calendar year 2008, based on a survey of traders and actual transactions contract terms.[13] Dow Jones provides data for the same geographic hubs for day ahead peak and

[13] *Platts*, a subsidiary of the McGraw-Hill Companies, provides energy information such as independent industry news and price benchmarks. *Platts* covers the oil, natural gas, electricity, nuclear power, coal, petrochemical and metals markets. Platts obtains its price data through its daily, confidential surveys of market participants. Through these surveys, *Platts* asks market participants to report all fixed-price physical and financial deals for delivery across key trading points in North America for each business day (and for longer time periods for its long-term assessment). The reporting of the data is consistent with FERC's standards which state that prices should be provided by individuals "separate from trading activities". See www.platts.com for more information.

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off-peak energy prices. The ICE also provides a similar daily index.[14] Amerex is a brokerage that provides information on bilateral trades on peak and off peak for SP15 and NP15 on a monthly, quarterly, and annual basis as far out as 2015.[15]

As such, it is evident that there is a fluid, competitive, and transparent wholesale power market in California, which enables the procurement and sale of electricity over different time horizons. Utility procurement generally occurs on a short to medium term, as compared to the longer time horizon that is covered in the aggregated summary tables that the NOI proposed to release.[16] As such, the arguments offered by the IOUs that the public release of such aggregated summary tables might distort the competitive procurement process seems to lack factual and logical grounding. The extent of publicly available, detailed information on demand and supply (as well as price indicators) is a key feature of the current market and any analysis of the ramifications of the release of the aggregated summary tables needs to take into account this reality.

5. The aggregated summary tables proposed to be released by the NOI cannot be reasonably deemed a "trade secret" as similar commercial information is already in the public domain. The aggregated summary tables do not represent wholly new information, but rather a refinement of the existing knowledge base. Economic theory on auction design, information policy, and financial risk suggests that such a refinement of information (and substitution of privately-developed conjectures by suppliers with a public

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[14] Note that data from the ICE is compiled and published by the 10X Group. See the following website for today's quotes: http://www.10xgroup.com/indc/?id=indc_napp_report.

[15] Amerex is leading broker of physical electricity sales, uniting buyers and sellers in power markets across North America. The brokerage service was started in 1996 and currently transacts over 4,000 GWh of energy daily across North America, with the bulk of these transactions in physical power. See http://www.amerexenergy.com/electrical_power.aspx.

[16] Transactions are done typically over a one to five year period (as demonstrated by the terms of the recent SCE RFO), though longer transactions are legally possible. According to the NOI, the CEC has agreed to hold confidential all data from 2006 through 2008. Thus, the aggregated summary tables being discussed in this proceeding are for the 2009 to 2016 period.

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information set) should generally benefit the buyers in terms of more efficient market outcomes. In other words, under competitive market conditions, we should expect better results for the buyers (lower prices) due to reduced uncertainty and more aggressive competition among suppliers.

Proxies for the aggregated information proposed to be released in the NOI are readily available. The aggregated summary tables simply allow the public, including the suppliers, to recalibrate and refine their understanding of possible future supply-demand conditions. Dr. Michael Jaske discusses both the disclosure of similar data by other IOUs that are part of the Western Interconnect and the release of related data that would potentially allow users to extrapolate comparable information about California's demand and supply conditions. PG&E's witness, Mr. Shandalov, concedes in his testimony that there is a lot of similar basic data already available when he notes that the suppliers will be able to rely on FERC Form 1 data to "interpolate".[17] Similarly, SCE's witness, Kevin Cini, also concludes that "much of the existing supply information… is already in the public domain."[18]

In direct conflict with actual market dynamics and the intent of the NOI on the aggregated summary tables' release, Professor Plott's experimental study abstracts from reality and assumes that no information is known to buyers on suppliers' willingness to sell in most of the experiments (i.e., those sessions involving "Sellers Informed"). Suppliers are informed of individual buyers' *complete* willingness to buy but that same information is not disclosed to other buyers. The aggregated summary tables' release as recommended by the NOI would not produce these asymmetries – all market participants would have access to this refined information on expected supply-demand conditions.

17 *See* Shandalov at 13.
18 *See* Cini at 15.

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Moreover, Professor Plott assumes that there is no "public transaction price information," as that would inevitably change the outcomes observed in his experiments by providing some additional knowledge of trading conditions.[19] As noted previously, there are in fact many robust indicators of overall market prices in the short- to medium-term (despite the decentralized nature of the bilateral market) available to all market participants in California today from a number of independent third-parties, including trade publications, brokerage institutions, and over-the-counter trading platforms.

The aggregated summary tables thus represent incremental or substitute information to the information that is already in the public domain or has been developed or extrapolated privately by potential sellers. Given this more accurate representation of the aggregated summary tables, we can review the theoretical implications of such information revelation on the procurement process.

Procurement has been described by academics as akin to an auction process, because in a Request for Proposal ("RFP") or RFO, the buyer(s) will be soliciting and analyzing multiple offers from different suppliers simultaneously. Thus, through the competitive nature of the selection process, the procurement processes of the IOUs are generally characteristic of an auction.[20] It is therefore useful to look to the theory of auction design[21] to determine the possible impact of the release of the aggregated summary tables on procurement outcomes. Information policy is a key component of the overall framework by which

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19 *See* Plott's Exhibit A at page 4.

20 Milgrom, Paul *Putting Auction Theory to Work* (Cambridge University Press) 2004, pg. 211-212.

21 Economists have applied the principles of auction theory to many questions, including wage determination (see Margaret Stevens "Labour Contracts and Efficiency in On-the-Job Training" *Economic Journal* 1994), political economy (Feddersen and Pesendorfer "The Swing Voter's Curse" *American Economic Review* 1996), and takeover battles (Bulow, Huang, and Klemperer "Toeholds and Takeovers" *Journal of Political Economy* 1999). Indeed, electricity markets have been specifically identified as auction markets in numerous academic publications.

economists distinguish and discuss the types of auctions and their equilibrium properties.

In well-accepted economic theories of auction design and information economics, dissemination of information that helps refine the participants' views on the value of the product being sold/bought is generally considered efficiency enhancing because it reduces private values and uncertainties, and in so doing motivates more aggressive competition. The risk-reduction benefits of additional information can also expand the horizon of bidders (statically, by lowering the threshold cost of participation, and also dynamically, through incentives for new entrants).

Auction theory establishes a number of conditions which, if met, indicate that the price the auction arrives at is efficient – that is, the price is an accurate assessment of the market value of the product being transacted. Paul Klemperer summarized these conditions in a recent article: "What really matters in auction design are the same issues that any industry regulator would recognise as key concerns: discouraging collusive, entry-deterring and predatory behaviour."[22] An efficient procurement process has a number of desirable characteristics: it allocates transactions to the lowest cost suppliers, it provides buyers with the lowest available prices, and the prices themselves account for all the information available in the market. Thus, the ability of an auction market to incorporate all the available information has serious implications for the efficiency of the market outcome and also attainable equilibrium between buyers and sellers.

In auction theory, auction mechanisms and equilibrium outcomes are distinguished by the type of information that participants have access to on the value of the product being transacted: public information and private information. Public information is available to all parties, and private

[22] Klemperer, Paul "What Really Matters in Auction Design" *Journal of Economic Perspectives* 2002, pg. 169-189.

information is available to only a limited number of parties or one single party. In the critical examination of this topic, Milgrom and Weber analyze the impact that public and private information have on auction prices. They determine that having private information allows a company to make excess profits – a form of market inefficiency.[23] Thus, information dissemination that reduces private information is generally efficiency enhancing and profit-enhancing for the buyers (i.e., returns prices to pre-'market failure' levels). This is especially the case if the information revealed by the buyers to all suppliers *substitutes* for the "private information" developed by certain suppliers. The aggregated summary tables would achieve such an objective because of their wide public release in the *2005 Energy Report* process.

Classic economics holds that "the value of information cannot be negative. Relevant information allows more accurate decisions, and irrelevant information can just be ignored."[24] However, as noted by Professor Plott in his experimental study, with the added complexity of game theory, information can hurt a party because it alters the way others behave and – from the buyer's perspective in the procurement processes – can influence the relative timidity of the bidders (suppliers) and thus affect the expected purchase price in the procurement processes. The key to determining the likely impact of information is to define the value of the "new" information in relation to participants' motivations and pre-existing information positions. If the revelation of "new" information by the buyers reduces private information held by certain suppliers, it will encourage more intense competition and increase the expected profits for the buyers (this is known as the *publicity effect* in auction theory). Moreover, if the buyers' revelation is a substitute for the supplier's pre-existing private information on

[23] Milgrom, Paul and Robert Webber "The Value of Information in a Sealed Bid Auction" *Journal of Mathematical Economics* 1982, pg. 105-114.

[24] Milgrom, Paul *Putting Auction Theory to Work* (Cambridge University Press) 2004, pg. 175.

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the value of the product being transacted, then it also motivates competition and reduces bidders' (suppliers') profits to the benefit of the buyer(s) (this is referred to as the *weighting effect*).[25] Clearly, the aggregated summary tables being considered for release in the NOI are incremental information that would widely disseminate the same refined information about supply-demand expectations to all suppliers and all buyers. Furthermore, it would supplant some suppliers' previously developed conjectures about supply-demand balances, thus addressing the detrimental impact of private information to auction results.

Information dissemination as envisioned by the NOI also reduces uncertainty for suppliers. One key way that revelation of information reduces risk is by decreasing the chance that a winning bidder (in this case, selected supplier(s) from an RFO) will suffer the "Winner's Curse", where the supplier wins the supply contract, but ultimately loses money because his winning bid was based on incorrect internal estimates (incorrect private information).[26] In their 2002 paper on the IPO market, Jeremy Bulow and Paul Klemperer present evidence suggesting that more information reduces the uncertainty premium

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[25] For a summary of the formal discussion of the publicity and weighting effects, see pg. 157-207 in Paul Migrom's *Putting Auction Theory to Work*. See also Paul Milgrom and Robert Weber "The Value of Information in a Sealed-Bid Auction" *Journal of Mathematical Economics* 1982; Richard Wngelbrecht-Wiggans, Paul Milgrom and Robert Weber "Competitive Bidding with Proprietary Information" *Journal of Mathematical Economics* 1983; Robert Wilson "Competitive Bidding with Disparate Information" *Management Science* 1969; Zvika Neeman "The Relevance of Private Information in Mechanism Design" *BU Working Paper* 2001.

[26] The winner's curse is a problem with common value auctions. Procurement of energy can be thought of as a common value auction because the commodity (electricity) is being transacted rather than the underlying generation asset (the sale of which is likely to be more akin to a private value auction because of unique technological and operation differences between different assets). A common value auction is formally defined as a process in which if all sellers held the same information, they would set the value at which they sell their product equally. If the auction is based on unbiased estimates of value of the product, it will result in an award of the supply contract to the most over-optimistic seller, who is then destined to make losses. Suppliers, knowing this is the case, incorporate a risk premium in their offers. The result is that the risk of unresolved winner's curse increases their offer prices and, in consequence, the final sale price. Academic work on the winner's curse has been extensive, and highlights include Jeremy Bulow and Paul Klemperer "Prices and the Winner's Curse" *RAND Journal of Economics* 2002; Paul Milgrom and Robert Weber "A Theory of Auctions and Competitive Bidding" *Econometrica* 1982; T.J. Feddersen and W Pesendorfer "The Swing Voter's Curse" *The American Economic Review* 1996; Paul Milgrom "Auctions and Bidding: A Primer," *Journal of Economic Perspectives* 1989; Richard H. Thaler *The Winner's Curse* (Princeton University Press) 1991.

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that bidders build into their pricing models to account for the possibility of "Winner's Curse." Increasing access to information gives bidders (i.e., suppliers) more confidence that their valuation is correct, letting them bid more aggressively to beat out the competition.[27]

When bidders in an auction (i.e., suppliers in the procurement process) are risk-averse, revealing information may further reduce their private risk premiums, which they incorporated into their offers and thus reduce the price at which they are willing to transact. This interplay of risk and information policy is analyzed by Milgrom and Weber.[28] Risk-aversion classically defined by Von Newmann and Morgenstern[29] basically explains why individuals seek out insurance. The dictionary definition of risk-aversion explains this concept in terms of preferences: risk-averse entities are those who are "willing to pay money to avoid playing a risky game, even when the expected value of the game is in [their] favor."[30] In a corollary, IOUs are generally willing to buy forward and lock in prices for future energy needs rather than buy on the spot market. Similarly, suppliers are generally willing to sell their supplies forward. Thus, risk aversion appears to be a good characterization of market participants in these procurement processes, suggesting that information dissemination which reduces uncertainty would have beneficial repercussions for buyers and, thus, for ratepayers.

The efficiency-enhancing properties of the NOI proposal for the release of aggregated information tables on supply and demand are generally ignored by the IOUs because of their incorrect generic or abstracted consideration of the

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27 Bulow, Jeremy and Paul Klemperer "Prices and the Winner's Curse" *Rand Journal of Economics* 2002.

28 Milgrom, Paul and Robert J. Weber "A Theory of Auctions and Competitive Bidding" *Econometrica* 1982, pg. 1089-1122.

29 Von Neumann, John and Oskar Morgenstern *The Theory of Games and Economic Behavior* (Princeton University Press) 1944.

30 See http://hadm.sph.sc.edu/COURSES/ECON/RiskA/RiskA.html.

aggregated summary tables. PG&E's Mr. Shandalov claims that the basic, aggregated supply and demand data shows the price that the utilities are willing to pay for energy and thus can create either a price floor or incentivize suppliers to sell their power into other markets. Mr. Shandalov's argument that the aggregated supply-demand data reveals the IOUs' price expectations ignores a key fact: the aggregated summary tables that the NOI intends to release consist of quarterly or annual figures on capacity (and peak demand) and production (and energy), denominated in MW and MWh units (respectively). The aggregated summary tables do not include any price indicators, nor are the IOUs being asked to publicly disclose their proprietary outlook on future fuel prices, which would be a key determinant of the supply curve and thus the "dollar value" companion to the supply and demand figures which is necessary to determine the price. Metrics on supply and demand alone do not indicate price. Mr. Shandalov's concerns about the price implications of the aggregated summary tables also ignore the fact that suppliers have a vast basis of knowledge already in hand, including forward price indications from bilateral transactions reported in the various price indices from Platts and Dow Jones, as well as by brokerage entities like ICE and Amerex.

Professor Plott's experimental analysis, included in his testimony on behalf of SCE, has similar shortcomings vis-à-vis the reality of information already available and the character of the aggregated summary tables. Given the theoretical ramifications of the quality of information being disseminated and the underlying environmental conditions in the experimental sessions, it is not surprising that Professor Plott's study observed higher average prices. Professor Plott analyzed the impact of the release of wholly new and detailed information about the buyer's demand curve to each supplier, assuming no prior knowledge

and no other market signals.[31] This is a substantial abstraction of reality with respect to the aggregated summary tables and the existing knowledge base among suppliers. Though exact contract prices are indeed confidential, many robust price indicators are currently available, in addition to proxy data that allows suppliers to determine and project similar information.

Furthermore, the experimental study assumes that the release is completely asymmetrical: "Buyers only knew their own valuations, and did not receive any information on sellers' costs or other buyers' values."[32] However, this will not hold for the California market which has other relevant proxy information (the IOUs are well informed about each other's positions and have extensive data on suppliers through the various filings prepared by those suppliers to the state and federal regulators), nor would that be the case with the release of the aggregated summary tables per the NOI (which would be disseminated to all and thus preclude the asymmetry between buyers assumed in the experimental study).

As a result of the constructs of the experiment, Professor Plott's study analyzed the impact of the release of data at a much more restricted and granular level than anticipated by the NOI. In other words, Professor Plott's study was not designed to address the subtle issue of the impact of a single release of the aggregated summary tables, which offer refined information on an existing knowledge base. Thus, Professor Plott's conclusions, while interesting in a more abstract academic sense, may not have direct relevance to the situation raised by the NOI.

6. The NOI includes adequate controls to prevent market manipulation. First, the NOI is proposing the release of aggregated, non-resource specific

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31 *See* Plott's Exhibit A at page 10-11.

32 *See* Plott's Exhibit A at page 9.

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data, which would make it difficult for suppliers to identify the exact commitments of their competitors. Second, the first three years of the forecast time horizon (2006 – 2008) from the resource plans will not be released.

IOUs have typically contracted for terms up to five years.[33] Thus, confidentiality of the supply-demand balance is maintained for the majority of the IOUs' typical procurement cycle. Furthermore, it is imperative to observe that the aggregated summary tables are not "real-time" data – there will be a lag of at least six months by the time the aggregated summary tables are published as part of the *2005 Energy Report* process from the date of submission of the raw data (and possibly over a year since the procurement plans were prepared by the IOUs). Moreover, no updates will be forthcoming until the next IEPR process is initiated. Market conditions change dramatically over short time periods in these markets (as Mr. Shandalov concedes in his testimony).[34] A supplier cannot be certain exactly what has already been procured or negotiated with other suppliers. Suppliers in California's market will not have the benefit of "real time" updates, in contrast to the real-time data revelation scheme used in Professor Plott's experimental study.

Professor Plott's experimental study also fails to take into account the safeguard against strategic behavior introduced by the three year confidentiality window. In fact, Professor Plott notes that the price impacts he observed in his experimental study are concentrated in the initial rounds of negotiation, "during the equilibration phase of market interaction."[35] This implies that the price impact is muted over time[36], and that the buyers (IOUs) may be able to arbitrage

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33 However, initiatives spanning as long as ten years are possible under current procurement policies.

34 *See* Shandalov at 18.

35 *See* Plott's Exhibit A at page 14.

36 Professor Plott notes explicitly that "pricing advantages can persist even after prices converged to equilibrium, **as long as** the equilibrium contains a relatively **wide range** of prices. (emphasis added). *See* page 16 of Plott's Exhibit A. Intuition would suggest that a narrow range of prices is more likely. To the extent that the buyers are procuring for their "on-peak" needs (rather than for their needs in each

away the upward price pressure over time, especially if one considers the menu of transaction options available to buyers (and suppliers) and the time dimension of the procurement processes versus the stylized market environment utilized in the experimental study.

The aggregated summary tables will show total demand and total resources; the NOI does not propose to reveal the IOUs' marginal value of energy supply, which is exactly what the experimental study assessed. Professor Plott notes in his discussion that with the exception of "two Design C sessions", the "sellers received [detailed information about the minimum value that units were worth to buyers] before the first period and they were continuously kept up to date about changing information about the buyers."[37] This is a severe abstraction of the reality of the NOI proposal. The aggregated summary tables as proposed in the NOI would be equivalent to a single quantity point in contrast to the entire set of price and quantity pairs for each buyer that the experiment releases to suppliers. Moreover the NOI does not envision that the aggregated summary tables would be updated on a continuous basis over time. Indeed there will be a "reporting gap" as discussed above. However, the aggregated summary tables will still allow suppliers to re-calibrate their information set, which should provide for some risk reduction benefits, as discussed previously.

IOUs' concerns about market manipulation effectively treat the many current electricity suppliers as if they were as a single entity or as if they behaved in a coordinated fashion. This presupposes some sort of coordination or tacit collusion in the procurement process. Professor Plott frankly acknowledges his

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independent hour), their procurement strategy would be focused on a very concrete set of ("on-peak") demand conditions (rather than the entire set of varying hourly demand conditions). Thus intuition would suggest that their willingness to accept market prices would be defined by a narrow range of prices, subject to the intersection of "on-peak" demand and their expectation of supply (based on market conditions at that point in time). Moreover, this range of willingness to pay by the buyers would have been refined and further narrowed as a result of the information learned from previous negotiations.

[37] *See* Plott's Exhibit A at page 11.

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objective in analyzing the "incentives among competitors that also foretell upward pressure on prices."[38] At the same time, he never discusses whether the collusion (and higher prices) is the result of the trading mechanisms implied in the experiments or the underlying assumed market structure. For example, it is unclear from Professor Plott's testimony whether the experimental sessions accurately paralleled the number of buyers and suppliers actually present in today's California market. It is however evident that the experiments' trading mechanism were a simplified abstraction of the complex, inter-temporal trading regimes in California's electricity market.

The classic economics text on the subject of tacit collusion, the *Theory of Industrial Organization*, by Jean Tirole, gives conditions under which tacit collusion is likely to be successful. First, the market participants must be able to see each other's prices, so as to punish firms that undercut the other collaborators. Because the precise contract terms between the IOUs and the suppliers will remain confidential, this condition will not hold perfectly in the current and foreseeable market context in California. The second major condition for tacit collusion to be viable requires that all suppliers have very similar (symmetric) cost structures. Given the diversity of the generation portfolios held by suppliers serving the California market, this condition is also not easily met. A third market condition that promotes tacit collusion is the presence of a high concentration of suppliers. This is clearly not the case in California given the numerous generators in state and in surrounding markets. As the necessary conditions for tacit collusions are weakly, if at all, present in the California market, it is incorrect to presuppose that tacit collusion among suppliers is present. In fact, the lack of a transparent centralized price by which punishment can be made credible indicates that some suppliers are going to be heavily

[38] *See* Plott at 12.

incentivized to deviate from a collusive target and offer their supply at lower prices in order to secure contracts – in other words, aggressive competition is more likely than tacit collusion.

Notably, similar if not more detailed data was released (or was already available) in recent full-requirements procurement processes for retail load in several Northeast jurisdictions, as well as in similar procurement processes in the Western Interconnect. In spite of the release of such supply-demand information, the competitive nature of the processes was not harmed and the results of these procurement processes were generally consistent with prevailing wholesale market conditions. Below, I provide some brief details about two such procurement processes in the Northeast, as well as the recent RFO for Arizona Public Service ("APS").

Connecticut Light & Power's Transitional Standard Offer (TSO) Procurement Process, November 2004: Connecticut's Transitional Standard Offer ("TSO"), effective through December 31, 2006, was created to establish electric rates for those customers that were still on the TSO plan (i.e., had not switched to a competitive supplier). The TSO regulation specifically required that the cost of electricity, the Generation Supply Cost ("GSC"), be based on competitive market rates which reflect the actual cost of retail service provision, thereby sending proper price signals to Connecticut ratepayers about the electricity they consume. Thus, Connecticut's two distribution companies were required to conduct a competitive procurement process. The main purpose of such a process was to minimize the total cost of the GSC. A second, but equally important, goal was to ensure that the procurement process did not give the utilities' unregulated generation affiliates an unfair advantage.

CL&P and United Illuminating had separate procurement processes. For each process, the utility released a detailed set of historical and forecast demand

data aimed at providing potential suppliers with an accurate picture of the utility's supply needs. For example, in Connecticut Light & Power's ("CL&P") 2004 auction for TSO supply for 2005 and 2006, CL&P released historical hourly load data from 2000 through August 2004, forecasted energy requirements and peak load by block[39] for each month and term (the terms were 2005 and 2006), forecasted hourly load for 2005 and 2006, average load profiles for each of CL&P's different customer class segments, and the number of CL&P customers by customer class segments. In addition to the information provided directly by CL&P, potential suppliers had access to supply-demand dynamics, transmission constraints, and other developments within New England and specifically in Connecticut. For example, the *2004 Regional Transmission Expansion Plan* ("2004 RTEP") published by the Independent System Operator of New England ("ISO-NE") was available at that time and provided detailed data spanning the next ten years at a New England, Connecticut state, and Southwestern Connecticut sub-region level regarding forecasted annual load, peak load (under 90/10 and 50/50 weather conditions for both summer and winter), reserves, total installed capacity, unavailable capacity, import limits, as well as other likely sources of supply. In addition to this, RTEP also provides supply-demand forecasts at a sub-regional level under a host of different scenarios, with accompanying energy price projections, for the next ten years.

The release of CL&P's information and the availability of other detailed market information, such as that contained in the 2004 RTEP, did not result in any manipulation or gaming of the market. Indeed, in my role as the auction's monitor alongside with the staff from the Connecticut Department of Public Utility Control ("DPUC"), I testified to the DPUC Commissioners that "CL&P's

[39] The CL&P auction, which was for approximately 5,000 MW of peak demand, was split into eight blocks of 625 MW of supply.

TSO procurement process was fair and impartial to all participants."[40] I found that the bids in the auction were in line with New England wholesale market conditions at that time.

New Jersey's Basic Generation Service ("BGS") Auctions: Starting in August 2002, the New Jersey Electric Distribution Companies ("EDCs") have used an annual auction mechanism to procure their default supply obligations (BGS) for those retail customers who had not switched to competitive suppliers. Based on the regulation implemented alongside this process, the resulting auction prices would be approved by the state regulator (the NJ Board of Public Utilities ("BPU")) and passed on to end customers, as long as certain protocols were met. Similar to the TSO process in Connecticut, the objective for using the auction mechanism was to procure electricity supply for NJ's BGS customers at a cost consistent with wholesale market conditions. Indeed, the BGS auctions have been credited with facilitating the development of a more competitive wholesale market by some observers.

In the auction process, the retail load was subdivided into two types – an "FP" class, serving smaller retail customers; and a "CIEP" class, serving large industrial clients. During these auctions, bidders bid on full-requirements tranches - each tranche representing a fixed share of the load, based on the peak load for each utility – for these loads. The winners were obligated to provide full-requirements service, including capacity, energy, ancillary services and transmission, and any other services required by PJM (the wholesale market operator and regional transmission organization).

To facilitate the bidders' estimates of their obligations, the EDCs released extensive data. Each utility released several years' worth of hourly load, daily

[40] Affidavit of Julia Frayer to the CT DPUC in Docket No. 03-07-18PH02, Establishment of the Process for the Procurement of Transitional Standard Offer, November 8, 2004.

peak, and transmission data. The data was also broken down by FP and CIEP classes and by actual and forecast BGS load. Data was also provided on customer switching. As in CT's TSO process, suppliers also had access to a variety of other market intelligence, including PJM's extensive supply-demand forecasts by sub-region, analysis of binding transmission constraints, and consideration of potential new entrants (based on interconnection queues).

The release of such detailed information did not result in any manipulation or gaming of the market. In fact, the consultant retained by the BPU to monitor the annual auction results has recommended that the BPU accept the auction outcome as fair in every year since the inception of this procurement process.

The success of such information disclosure in a procurement setting is not unique to the Northeast. As part of its March 31, 2005 RFO process, APS specifically released its resource plan summary tables as part of the procurement process. In this release, APS provided information about its annual energy and capacity needs, resources, and net position. APS also provides monthly data about energy usage, broken into category of resource and monthly need for the resource, a much more detailed data provision than is envisioned under any of the NOI proposals.

7. **Release of the aggregated summary tables may be efficient for overall market operations in the long run and in the ratepayers' interests. The information encapsulated in the aggregated summary tables will provide accurate and necessary signals on the need for new generation investment, further supporting the development of a robust competitive electricity industry and secure, least cost supply for ratepayers.**

Restructuring has eliminated the centralized nature of planning and system expansion prevalent under the previous model of vertical integration in

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California. Nevertheless, even in a restructured (deregulated) market environment, there is still a basic need for informal, yet centralized, coordination of investment needs. The CAISO has taken on some of this role as coordinator with its analysis of economic transmission needs within its control area. The CEC has also been tasked with a "coordination" role through the IERP process. The information embodied in the aggregated summary tables would indicate the investment requirements of the system in the long term to the various market participants and thus allow the CEC to fulfill its duties in this regard.

The potential for new investment is part of the market landscape in California. This observation is underscored by the standardized process for permitting and siting new generation in the state - a regulatory feature that has undoubtedly supported the development of new generation in the state. New generation offers an expansion of the possible universe of suppliers that buyers can procure from. The analyses presented by the IOUs generally ignore this potential. This is not surprising, since the IOUs' acknowledgement of the dynamic, long run benefits of information dissemination for motivating investment would offset their concerns about market manipulation among existing suppliers.

For example, Professor Plott's experimental study looks at short-term dynamics. Though Professor Plot observes higher prices on average in the initial rounds (sessions) of negotiations in the simulations, he also assumes a static environment with no new entry. In fact, Professor Plott concedes that on the basis of higher prices, his study "does provide indirect evidence that entry could be attracted by greater information dissemination..."[41] Experience in power markets worldwide has shown that expectations about long-term supply-demand balances attract investment simply on the face value of the *expected*

[41] *See* Plott's Exhibit A at page 2.

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aggregate shortfall between supply and demand. Indeed, such a phenomenon clearly occurred in New England in the late 1990s. In 1997, New England's summer reserve margin ranged from just above 0% to 3% for June through August of that year, resulting in major efforts by the system operator to maintain sufficient resources to meet the summer's demand.[42] NERC's 1997 reliability assessment identified this capacity shortage as a problem not just in the short term but also potentially through the beginning of the next decade. This triggered a major generation capacity development cycle in New England, with about 1,500 MW of capacity coming on-line in 2000 and in 2001 and a heady 2,800 and 2,900 MW in 2002 and 2003.[43] These increases in capacity, driven by the tight supply margins exhibited by the region from 1997 through 1999, resolved the region's supply shortage, resulting in a current healthy supply margin in New England of more than 20%.[44] Accordingly, the amount of capacity that has recently come on line is much lower than the early 2000s: less than 600 MW came on line in 2004. Such a phenomenon was also observed in ERCOT in the late 1990s. ERCOT's reserve margin decreased from 19-24% over the summer of 1996 to 13-18% in 1999, encouraging the development of large amounts of additional capacity in the region.[45] Indeed, more than 5,000 MW came on-line in 2000 and more than 7,000 MW in 2001.[46]

Professor Plott's supposition that "competition itself is reduced"[47] would in fact be reversed in the long term due to the introduction of new supply resources (either from new build in California or re-directed resources from surrounding regions), if his experimental study allowed for this dynamic

42 NERC Summer Supply Assessment, 1997.
43 ISO-NE data.
44 NERC Summer Supply Assessment, 2004 and 2005.
45 NERC Summer Supply Assessment, 1996-2000.
46 Public Utility Commission of Texas, *Generation Projects Completed in Texas Since 1995*, February 2005.
47 *See* Plott at 10.

response to prices and informational expectations. In other words, to the extent that there are no artificial barriers to entry, new supply will discipline the manipulation that the IOUs so strongly fear.

Moreover, if aggregated summary tables on supply-demand balance are not allowed to be released, substantial uncertainty on future market conditions will remain, especially if the current base of knowledge deviates from utilities' expectations about their needs in the long term. New long term supplies will not materialize and the higher prices that the IOUs fear will be realized, but precisely because the IOUs withheld beneficial information for new investment. Michael Spence's 1973 seminal work served as a foundation of "signaling theory."[48] In this paper, he uses education to lay out a theory: job market participants signal their quality by their decision to pursue education.[49] The theory developed by Spence and others suggests that when one market participant has information that is unknown to the counterparties, and is favorable to future interactions, it will make sense to communicate that information. Moreover, signaling theory also suggests that when one market participant has information that is unknown to the counterparties, it may be able to improve its own position by communicating the private knowledge. In the current context, where the IOUs are the best informed about the future supply-demand balance, they can encourage the market to make the optimal investment in generation by making releasing their expectations through the aggregated summary tables. Indeed, the

[48] Signaling theory has been one of the most studied areas of economics since it was introduced. Indeed, it has been deemed important enough that its three main developers, George Akerlof, Michael Spence, and Joseph Stiglitz received the Nobel Prize in economics in 2001 for their contributions. Key writings on signaling theory include George Akerlof "The Market for Lemons: Quality Uncertainty and the Market Mechanism" *Quarterly Journal of Economics* 1970; Michael Spence "Job market signaling" *Quarterly Journal of Economics* 1973; Joseph Stiglitz and Michael Rothschild "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information" *Quarterly Journal of Economics* 1976; I.-K Cho and D. Kreps "Signaling Games and Stable Equilibria" *Quarterly Journal of Economics* 1988; A. Mas-Collel, M.D. Whinston, and J.R. Green, *Microeconomic Theory* (Oxford University Press) 1995; Drew Fudenberg and Jean Tirole, *Game Theory* (The MIT Press) 1992.

[49] Spence, Michael "Job market signaling" *Quarterly Journal of Economics* August 1973, pg. 355-379.

non-release of this long-term aggregated supply-demand data could lead to higher prices and possible lapses in reliability. Even if for the moment we accept the IOUs' arguments of higher prices and specifically rely on Professor Plott's experimental study (where moderate average price differentials in the 7% to 8% range[50] were observed), the cost to ratepayers of correcting under-investment in the long run is likely to far exceed the increased cost of procurement over the short-term as the market converges towards equilibrium prices. Now if we take into account the actual market structure (with many suppliers) and the actual characteristics of the proposed aggregated summary tables, near term prices may actually fall with the release of the information in the aggregated summary tables (due to the risk-reducing effects of public value information that substitutes for and refines the existing private information). We must also consider other ratepayer benefits that will be created by the information release. These include the possible trading efficiencies that were not captured in Professor Plott's experimental study[51] and the long term ratepayers' benefits offered through signaling for investment.

8. **Concluding Remarks:** In my practical experience and based on well accepted economic theories surrounding auction design and information access, I believe it would be beneficial to ratepayers and imperative for efficient long run market dynamics to have aggregated long-term supply and demand information in the public domain. Such information would provide constructive signals for new investment for suppliers and investors. The "manipulation" and "higher price" concerns raised by the IOUs would, in turn, be ameliorated through the introduction of new investment (and even perhaps through the expectation of the introduction of new supply). In summary, the aggregated summary tables

50 *See* Plott's Exhibit A at page 14.
51 Id.

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that the IOUs are asking to suppress from public circulation are not confidential and their release should enhance current signals for necessary new investment in California's electricity sector and thus be beneficial to ratepayers.

Though Professor Plott's experimental study is innovative and on the cutting edge of experimental science, it necessarily simplifies (as all studies have to) real world conditions and thus does not consider nuances related to the differences in the quality of information revealed, the timing of the information revelation process and the timestamp of the underlying data, the degree of actual competition in the market based on the number of participants and structural complexity, the impact of potential new entrants, and the ramifications of the flexibility and multitude of options available to buyers and sellers to transact over time. Thus, the study conclusions, though robust in the experimental framework, may not be as applicable to the actual California market.

I declare under penalty of perjury under the laws of the Commonwealth of Massachusetts that the foregoing is true and correct.

Executed on June 8, 2005 at Boston, Massachusetts.

Julia Frayer

Appendix A: Resume for Julia Frayer

KEY QUALIFICATIONS:

As Managing Director of LEI, I currently direct many of the company's engagements involving market design and policy making in electricity markets, particularly with respect to auction design and market power regulations. I have provided consulting services to many clients on auction design practices for the energy sector for both physical assets and financial derivatives, including recommendations on selecting auction formats for the sale of physical generating assets as well as financial energy-related products, market rules to enhance competition, and holding restrictions to limit collusive behavior and uncompetitive market outcomes in the aftermath of the auction process.

As director of many of the quantitative engagements at LEI, I have also led many projects involving strategic bidding and simulation modeling in the power sector, including economic support in mergers and acquisitions, development of trading strategies, and contract negotiations. For example, I have advised industrial clients on procurement strategies and assisted in their contract negotiations with suppliers. I have also participated in the buy- and sell-side of generating asset divestiture processes in markets worldwide, including in California's original asset divestitures, where I led a team of economist developing the long-term economic valuation of various utility assets. In 2001-2002, I co-led a large engagement for the California ISO and various California stakeholders, for which we designed a prototype economic transmission evaluation framework that incorporated the complex interactions between transmission expansion and generation, assessed the value added of market power mitigation from transmission expansion, and explicitly valued the real option to delay investment in the cost-benefit analysis. Key elements of the methodology were implemented by the CAISO and are currently in use by the transmission planning department to assess the economic benefits of potential wires projects.

I have also presented testimony in arbitration and mediation proceedings involving contract disputes and the impact of new, unanticipated, information on bidding practices and market price settlement processes in a deregulated wholesale energy market in North America. I have also provided testimony on the competitive effects of mergers and market power issues at the Federal Energy Regulatory Commission ("FERC"), as well as in front of the Public Utility Commission of Texas ("PUCT") and in front of other state regulators.

I have also advised on retail market issues in the electricity sector. For those customers seeking to buy electricity, I have provided forecasts of wholesale and retail electricity rates and recommended procurement strategies based on their consumption profiles and market expectations. Last year, I assisted Connecticut's Department Of Public Utility Control's ("DPUC") Utility Operations and Management Analysis unit in monitoring the power procurement processes for Connecticut Light & Power's ("CL&P") Transitional Standard Offer ("TSO") auction in November 2004. I provided testimony evaluating the auction process to the DPUC.

EDUCATION:

Graduate School of Arts & Sciences, Boston University (1996-97) **M.A.** in Economics
College of Arts & Sciences, Boston University (1994-97) **B.A.**, Summa Cum Laude, in Economics and International Relations, member of Phi Beta Kappa

EMPLOYMENT HISTORY AND SAMPLE PROJECT EXPERIENCE:[52]
From: February 1998 **To**: present

Employer: *London Economics International LLC*

- ***Testimony at FERC on behalf of intervenor in proposed Exelon-PSEG merger related to wholesale market issues in generation per Section 203 of the Federal Power Act:*** Julia provide direct and supplemental testimony outlining key considerations relating to the potential for adverse competitive effects in light of the proposed merger and recommended additional mitigation measures to cure horizontal market power concerns through independent analysis of merger's impact on wholesale energy and capacity markets in PJM.

- ***Advisory to the Alberta Department of Energy on market power safeguards for the Alberta electricity sector:*** As part of the London Economics team, Julia managed the theoretical analysis and quantitative simulation modeling in the design and testing of recommended new regulatory regime. Analysis and recommendations will be presented to stakeholders in the spring of 2005.

- ***Economic Support of generation*** acquisition by investment funds in PJM: Julia is leading a due diligence team and assisting in the exclusivity negotiations with respect to an acquisition of a 400+ MW coal fired plant in the PJM market by a group of private investors. Julia's role included management of LEI's economic appraisal,

[52] This is a sample of relevant engagements. Not all projects included.

coordination of preliminary technical due diligence, negotiations with third parties on possible of-take arrangements, and oversight over financial modeling.

- ***Economic analysis and expert testimony in front of the Public Utilities Commission of Texas on market power related issues:*** prepared and filed testimony and quantitative analysis on questions of market definition and market integration. In June 2005, Julia participated on panel discussing market monitoring issues, as well as market power safeguards for wholesale electricity markets. In 2004, she also provided testimony on pricing safeguards proceeding, which looked at alternative market power testing procedures for market power, analyzed implications on investment, and discussed efficiency consequences of certain bidding behavior.

- ***Contract analysis and risk management:*** Julia led analysis of large market participants' collar contract positions within its overall portfolio-wide risk management strategy in Northeast market. Analysis and risk management recommendations will be presented to Board of Directors.

- ***Asset optimization for international generation-only company:*** Using application of methods and quantitative techniques from Modern Portfolio Theory, Julia participated on LEI team working on a first stage review of a multinational firm's generation asset holdings, scope for efficiency improvements, risk reduction, and identification of areas for increased diversification potential.

- ***Preparation of analysis for generation market power under FERC's indicative screens for market based rate authorization:*** In support of various acquisitions by Brascan and Emera in the Northeast announced in 2004, Julia has prepared and continues to be involved in expert testimony for Market-based Rate Authorization applications, Triennial Reviews, and Section 203 filings. All applications to date have been successfully accepted by FERC.

- ***Market analysis and forecasting for IPP developer in Ontario in response to Ministry of Energy's RFEI for 2,500 MW of clean energy:*** Julia directed the quantitative analysis and wholesale electricity price forecasting completed for an IPP. Projections were used to justify project sponsorship of a small gas-fired plant in front of the IPP's Board of Directors and led to project submission to RFEI. In addition, Julia and her team of economists designed a risk model for the client to evaluate the contract payment risks vis-à-vis actual dispatch.

- ***Resource adequacy workshop:*** Julia co-presented at an IPPSA-sponsored workshop in Alberta on resource adequacy market institutions, specifically speaking to the

installed capacity and locational installed capacity markets implement in the US among certain Northeastern ISOs.

- ***Econometric analysis of the elasticity of demand for transmission services between Canadian provinces and US markets in the Northeast:*** Julia led the economic analysis for an IPP investigating the impact on trade from increased transmission costs, involving multi-factor regression analysis of nodal electricity prices, price spreads across markets, and interchange flows (imports and exports) across borders. Analysis will be used as evidence in a regulatory hearing for proposed tariff changes.

- ***Monitoring of 5,500 MW RFP for energy services for standard offer contract issued by Connecticut-based utility:*** the Department of Public Utility Control of Connecticut retained the services of LEI to assist the DPUC in monitoring the power procurement processes for Connecticut Light & Power's (CL&P) Transitional Standard Offer auction in November 2004 for services in 2005 and 2006. Julia led LEI's team in providing advisory services to the DPUC, including guidance on communications protocols, design of sales contract agreement (between CL&P and winning bidders), and also valuation of final bids vis-à-vis the forward market alternatives available to the utility. Julia filed an affidavit after completion of the process which the Commissioners used to approve the process and the contracts between CL&P and the winning bidders.

- ***Economical advisory on market power mitigation tests:*** for a large US-based utility in the Southwestern part of the US, consulting on market design features related to a proposed nodal market, including most significantly the market power analysis framework. LEI proposed strategy and is assisting in the development of an implementation framework for the local market, including prepared reports for the market design team and state commission. In addition, the approach will be proposed for federal review at FERC.

- ***Analysis of LMPs in New England:*** using well-established econometric techniques, analyze location-based marginal prices in New England since inception of the new nodal system. Assess the node-specific marginal loss and congestion premiums for certain assets located in load pockets. Analysis integral to a valuation of a portfolio of generation assets and power supply agreements.

- ***Economic advisor to large European power company in its acquisition of an electric distribution franchise in Eastern Europe:*** Julia, along with her team members, assisted a large European power company in its acquisition strategy in Romania. Project involved government and stakeholder consultations, proposed modifications

to market design and regulatory structure, including the implementation of a performance based ratemaking regime. London Economics was also responsible for forecasting tariffs - which were an integral part of the overall financial model and supported the proposed purchase price.

- ***Assessment of Austrian hydroelectric generation*:** Julia was asked to provide an economic opinion for a US-based investor involved in a cross-border acquisition of certain hydroelectric assets. Julia's opinion detailed the appropriate WACC and price forecast that should be used in the valuation, based on current and proposed structure of the power market, and provided an assessment of the marketability of the service contract involving an exchange of market-based revenues (energy and ancillary services) for a fixed cash payment between the owner of the assets and an independent counterparty. For this project, extensive financial analysis of reasonable costs of capital for generation-only investments was done, including adjustment factors for various risk factors unique to hydroelectric assets. In addition, LEI performed a multi-scenario financial analysis of the service contract based on projected exchange of funds.

- ***Valuation of a pumped storage facility:*** in support of an asset bid by a multi-national player, Julia and her team of economists and modelers completed a medium-term analysis of potential peak versus off-peak price trends in a key Eastern Interconnect market. The price forecast was based on both network simulations using marginal cost-based bidding and strategic bidding. The strategic biding analysis was based on an innovative algorithm, referred to as ConjectureMod, developed by LEI in consultation with a well-known game theorist in electric power markets.

- ***Extensive economic support of a private client's acquisition of a New England-based generating portfolio:*** as part pf an on-going engagement, Julia is assisting a large Canadian private client in its acquisition of a large New England generation portfolio. Julia and her team supported the client's valuation team, providing extensive forecasting and revenue modeling support for the bid development, due diligence, and cost-benefit analysis of key components of the portfolio (which contains an assortment of power plants, ranging from coal-fired facilities to hydro units, and other power sector-related assets, such as transmission rights contracts, power purchase agreements, and power supply obligations). London Economics, with Julia's support, is currently working on FERC filings in anticipation of the acquisition, which will assess the market power attributes of the transaction, per Section 203 requirements. In addition, London Economics'' quantitative and modeling analysis will be used to support securitization and credit rating efforts which may include the acquired assets.

- ***Development of a methodology for transmission assessment for the CA ISO:*** LEI, in association with Professor Robert Wilson of Stanford Business School, ECCO, and Dr. John Smalls, was engaged by the California Independent System Operator (CAISO) to construct a framework for the economic valuation of transmission investment. Though grounded in a cost-benefit analysis approach, the methodology moved beyond traditional valuation frameworks and incorporated concepts from real options investment analysis and game theory, and included innovative techniques for forecasting market power implications for wholesale power markets. In the last phase of the project, LEI demonstrated the practical application of the methodology to a real-world transmission investment. The work, completed jointly with the CAISO, was filed with the CPUC in late 2002. As a result of this work, LEI developed a linear program model, which combined with econometric techniques, helped resolve and evaluate the question of generation and transmission interdependence. Key elements of this project have been implemented in CAISO's current valuation practices of economic transmission investment projects.

- ***Support the Balancing Pool on economic issues related to the MAP II sale of dispatch rights associated with key generation assets currently controlled by the Balancing Pool:*** conducted an in-depth analysis of current and future market outcomes under a variety of ownership structures (required multi-year simulation modeling of strategic behavior using CUSTOMBid) for energy and ancillary services market in Alberta, quantitative analysis served as foundation for the design of efficient holding restrictions that would be applied to the sale of the Clover Bar, Sheerness, and Genesee contracts; consulted the Balancing Pool, MAP Committee, and associated parties on sale process and auction design principles; provided an independent valuation of the contracts using an options-based approach based on London Economics' proprietary spark-spread model.

- ***Determination of reasonable rates and subsidy payments for a water business in Germany, as part of US cross-border lease transaction:*** managed an economic valuation and forecasting exercise in support of a combined $1 billion plus transaction involving several wastewater and freshwater systems (treatment facilities and collection and distribution networks) in Germany. As part of the economic analysis, forecast reasonable rates for the water and wastewater businesses based on true cost recovery principles. In addition, provided industry expertise in the design of a subsidy mechanism, to overcome certain legal obstacles in local jurisdiction's laws with respect to return on investment vis-à-vis fair market value.

- ***Evaluation of a structured financial agreement (swap) or service contract with respect to district heating network in Austria:*** directed the economic analysis of the

financial instrument which involved the quasi-securitization of the income streams of a district heating distribution business in Austria; supported the legal counsel in the due diligence process and contributed to the design of the transition structure with respect to the financial arrangement; analysis and final opinion provided backing for a US cross-border lease.

- ***Valuation of international transmission project***: using a real options application involving locational price spreads, designed specifically for this engagement, Julia and her team of economists quantified the congestion rents expected to be earned by the developer of an international transmission line in North America and thus evaluated the private benefits to the transmission owner.; financial model constructed for developer to use in analyzing economics of the project on an on-going basis, in order to win Board approval and negotiate risk-sharing contract terms with co-sponsor.

- ***Preparation of valuation for a successful bid in a generation auction in Ontario:*** Julia assisted Brascan Energy in the valuation of the Mississauga hydro portfolio, which they acquired through a successful bid, from Ontario Power Generation. Economic analysis involved the use of LEI's market power analysis (using London Economics' proprietary game theoretic model of strategic behavior), LEI's production cost-based simulation software, POOLMod, and London Economics' tailored real options-based approach for hydro assets. As part of this engagement, LEI staff participated in the initial round analysis, aided in the due diligence process, and consulted the client on second-round bidding.

- ***Market study of the Southeast US and projection of power purchase options for a 400-MW load facility siting at the cross-roads of several Midwest and Southeast markets (SERC, SPP, MAIN, and MAPP regions)***: in advising a large industrial customer on its power supply options (buy or build) over the medium-term, LEI conducted a joint economic and technical study of the power markets and transmission systems in the Southeast market; Julia coordinated the engineering assessment, involving extensive analysis of the security of the transmission grid through load flow analysis and contingency tests. Economic analysis build upon the transmission topography defined in the technical assessment and provided the client with a medium-term independent outlook on wholesale energy prices for the market, based on regional configuration and realities of the transmission system in this part of the country. LEI's POOLMod production cost simulation software used to complete the forecast.

- ***Economic feasibility study of a New York City cogeneration facility, a Western New York peaker, New York City CCGT (various clients)***: for a developer, prepared a ten-year revenue forecast for a proposed cogeneration facility, including a forecast of energy and capacity revenues (namely intrinsic revenues) and a volatility or real options-based adder (extrinsic revenues) for the New York City zone of the NY ISO. Analysis was used in support of board approval and aided in the design of the project (e.g., choice of technology and flexibility of such technology vis-à-vis expected market outcomes). For another private client, conducted a longer term projection (spanning 20 years) for a peaking power generation project in Western New York, producing a forecast for regional energy, installed capacity, options-based adders, and ancillary services revenues streams.

- ***Implementation of real options modeling framework:*** conducted numerous valuation exercises using real options-based framework for generation assets and transmissions rights for a variety of engagements, including asset valuation, and structuring of transmission rights portfolio.

- ***Valuation of Mid-Atlantic utility (private client), 2001:*** co-led economic aspect of valuation process for potential acquisition of Mid-Atlantic utility for international entity. Analysis included valuation of PJM-based generation portfolio through the use of production cost-based models and real options applications. Julia also coordinated evaluation effort for trading entity and regulated asset base (wires assets), including review of exposure due to provider of last resort obligations. Julia and her team of economists assessed contract portfolio and load growth parameters, as well as mitigation measures employed by target utility.

- ***Review of innovative leasing deal for electric and gas networks:*** for set of investment banks, performed engagement reviewing ownership arrangements for network assets, revenue drivers, and contract structure. Led detailed net benefit analysis for innovative swap structure, involving the cash flows from the network assets under performance-based regulatory regimes.

- ***Modeling of the future value of emissions reduction credits in regional, continental and global emissions trading markets:*** on behalf of large multinational client, Julia completed a study of the short to long term dynamics of the emissions trading markets. The majority of the focus was on greenhouse gas emissions and the potential for trade-able instruments in North America based on recent publicized transactions and pilot trading programs. However, discussion of current US emissions trading markets (for nitrogen oxide and sulfur dioxide) and their relative features was included in the report.

- ***Valuation of Ontario generating facilities, including assessment of regional electricity markets:*** organized and implemented major modeling effort to determine potential value of generation stations in Ontario. Assessed impact of transmission constraints and restructuring efforts in neighboring markets on future wholesale market prices; forecast competitive market price for Ontario over the long term with detailed review of market dynamics and key price formation drivers; projected the reaction of key market players and the implications of their actions of market prices over the near term utilizing proprietary game theoretic model.

- ***Measurement of contract exposure under a series of PPA contracts and its effect on enterprise value:*** this study was done in conjunction with a due diligence process, where London Economics was part of team analyzing a potential merger between an international power producer and diversified US utility. In identifying key issues in merger between these two entities, London Economics was given the task of defining and quantifying the liabilities associated with the US utilities' power purchase agreements. Julia lead the analysis on behalf of London Economics in the due diligence process: constructing a theoretical framework and applying it to complex asset swap and power purchase agreements in order to measure the magnitude of the liability via current and forecasted market conditions.

- ***Valuation of renewable portfolio of US-based IPP (ERGA's acquisition of CHI Energy):*** Julia co-led market analysis on behalf of ERGA (subsidiary of Italy's electric utility, ENEL) and its investment bankers in their successful acquisition of CHI Energy (a renewable generation IPP player). Tasks included detailed review of key NUG contracts, overview of regional power markets, price forecasting for half-dozen power markets, sensitivity analysis, and strategic going-forward assessment.

- ***Surveyed the current US environmental regulatory framework for international client and produced detailed compliance cost analysis for US generation asset operators:*** investigated current and future policy guidelines (including stay of OTAG program by Federal Courts), outlined key regulation and emission protocols under EPA's Acid Rain Program, Ozone Transport Regulation and New Source Review, measured the cost of compliance options for US generators through analysis of forecasted allowance prices, and the cost of technological mitigation implementation (BACT) and other emissions reducing initiatives (e.g. coal switching, operational guidelines). As a final product, Julia authored a working paper that laid out the multiple layers of environmental regulation for generators in the US with a detailed case study, defining the technological and cost impacts of this regulation on one large US utility.

- ***Review of market dynamics in the California market as part of generation asset valuation:*** London Economics was hired by leading financial institutions to review the long term energy, ancillary services, and capacity price forecasts for Southern California and resulting revenues for a set of assets that were undergoing debt financing. As part of this investigation, Julia drafted a critique of the proposed price forecast and suggested methodology improvements and a set of alternative price benchmarks for debt financing valuation purposes.

- ***Valuation of distribution assets:*** quantified synergies and developed strategies for potential cross-border transaction between top Canadian distribution corporation and affiliate of Top 20 US utility, by performing in-depth analysis of diversified strategies available to global energy companies in energy generation, transmission, distribution, wholesale and retail marketing, energy services, and other infrastructure industries. Julia co-managed a team of economists and consultants, pursuing unique valuation approaches in this transaction, utilizing comparable analysis, examination of PRB mechanisms and other regulatory pricing designs, growth strategies, as well as the application of real options theory.

- ***Midwest price forecasting:*** Julia headed the analysis of long-term price forecasts for the Midwest US (ECAR, MAIN, and MAPP); managing a team of economists in their effort to establish fifteen-year energy and capacity price forecasts for several US regions. As part of the modeling effort, London Economics proprietary dispatch simulation model, PoolMod, was used, in conjunction with a competitive capacity-pricing module. The long-term modeling effort required detailed investigation of the micro and macro-economic issues facing these regional markets: demand profiling, growth forecasting, reserve margin and new entry activity assessment. This analysis was used by a client in establishing market values for assets they have targeted to acquire over the medium-term.

- ***Completed initial modeling and organized competitive market analysis tutorial for the staff of the Italian Energy Regulatory Authority:*** worked with the regulatory advisors to the Italian government in their on-going effort to restructure the power sector in Italy. Julia, as part of an international team of economists consulting the regulator, led the competitive market modeling tutorial. She advised IERA staff on the use of London Economics' proprietary pool simulation model in assessing the current issues in the Italian generation market (such as potential market power problems) and market conditions after privatization/divestiture.

- ***Valuation of coal-fired generation assets in the NYPP:*** forecast energy and capacity prices for the New York market on a sub-regional basis, rooted in transmission constraint parameters. Utilizing London Economics' proprietary pool simulation

model, Julia composed detailed unit-by-unit performance, revenue and cost parameters over the next twenty years. In addition, she investigated the affect on market projections by varying key drivers and scenario assumptions, in an effort to bracket the perceived risks to clients. Julia studied the influence of several key market drivers, such as the implementation of various environmental programs, changes to system supply-demand profile due to various new entry/retirement profiles, modification of market rules, and shifts in key input markets (e.g. coal, natural gas and oil markets).

- ***Strategic review for major US investor-owned utility:*** performed in-depth analysis of the strategic implications of US deregulation by studying the impact of unbundling in the US on the fundamental economics of the electric power industry at all points on the value chain; identified regional investment opportunities congruent with these dynamics.

- ***Valuation of New England, PJM and Midwest generation assets:*** evaluated potential value of assets available under various regional auctions for a dominant IPP player. Julia worked with client in composing a bid proposal by assessing market risks posed by various factors, such as fuel price shifts, merchant plant construction scenarios, site conversion potential, and transmission constraints and through extensive production cost modeling.

- ***Strategic analysis of major UK firm's position in the Midwest:*** co-developed a model for the largest regional energy market in the US, in order to assess the client's holdings in the region, future IPP development and value of affiliates' contributions through the value chain: fuel provision, generation, and marketing.

PUBLICATIONS AND SPEAKING ENGAGEMENTS:

Frayer, Julia "Prepared Presentation of Julia Frayer for Market Monitoring and Surveillance in the context of Market Design." Panelist, *PUCT Workshop for Project #28500*, Austin, Texas, June 10, 2005.

Frayer, Julia "Written Statement of Julia Frayer for the January 27th 2005 Technical Conference in Docket RM04-7-000" Panelist, *FERC Technical Conference*, Washington D.C., January 27, 2005.

Frayer, Julia "Competitive procurement options for Ontario's LDCs" Speaker, *APPrO 2004 Conference*, Toronto, Ontario (Canada), November 24, 2004.

Frayer, Julia, Nazli Uludere, and Sam Lovick "Beyond market shares and cost plus pricing: designing a horizontal market power mitigation framework for today's electricity markets." *Electricity Journal,* November 2004.

Frayer, Julia "The World Changed on August 14th: the (Second) Great Northeast blackout." Chairman of Panel Session, *Electric Power Conference* 2004, Baltimore, Maryland, March 30, 2004.

Frayer, Julia "Alternative to LMP pricing for transmission: a case study of the ICRP approach used by National Grid Company in the UK." Speaker, *Electric Power Conference* 2004, Baltimore, Maryland, March 31, 2004.

Frayer, Julia "Big ticket leasing - what next for the future?" Panelist, *Big Ticket Leasing 2003*, London (United Kingdom), March 12, 2003.

Frayer, Julia "Evaluating the Electron Highway" Speaker, *IPPSO 2001 Conference*, Richmond Hill, Ontario (Canada), November 28, 2001.

Frayer, Julia and Nazli Uludere "What is it worth? Application of real options theory to the valuation of generation assets" *Electricity Journal,* November 2001.

Goulding, A.J., Julia Frayer, Jeffrey Waller "*X Marks the Spot*: How UK Utilities Have Fared Under Performance-Based Ratemaking" *Public Utilities Fortnightly,* July 15, 2001.

Frayer, Julia "How much is it worth? Applying real options valuation framework to generation assets" Speaker, *Electric Power 2001*, Baltimore, Maryland, March 22, 2001.

Goulding, A.J., Julia Frayer, Nazli Z. Uludere "Dancing with Goliath: Prospects After the Breakup of Ontario Hydro" *Public Utilities Fortnightly*, March 1, 2001.

Frayer, Julia and William Chapman "Improving price forecasting in wholesale power markets through the application of models of strategic bidding" Speaker, *EPRI International Pricing Conference 2000*, Washington, D.C., July 28, 2000.